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Trenching and excavation safety

Part three: Soil Classification By David V. Dow

Sadly, as many as 400 workers are killed and several thousand workers are seriously injured in trenches and excavations across the U.S. each year. One reason: Many people forget the weight of soil. The Facts: One cubic foot of soil weighs between 90 and 140 pounds. A cubic yard of soil can weigh almost 4,000 pounds, as much as an SUV! As a result, when a trench cave-in occurs, there are usually deaths or very serious injuries.

An important responsibility for the “Competent Person” (discussed in part one of this series) is “Soil Classification.” It is the first step in choosing a protective system, and the law requires it. Even if a soils engineering service has been identified for a project, the “Competent Person” is still required to classify the soil.

There are hundreds (maybe thousands) of different types of soil. OSHA is concerned with just four types:

Stable Rock - Defined as natural, solid mineral matter that can be excavated with vertical sides and will remain intact while exposed. Stable rock is extremely rare. In fact, less than two percent of the soil in the U. S. is classified as Stable Rock. In addition, the process of excavating with saws, breakers, dynamite, etc., will likely

fracture and de-stabilize soil that was initially considered stable.

Type A - Defined as cohesive soil with an unconfined compressive strength of 1.5 tons per square foot or greater. As a practical matter, Type A soil is also rare because previously disturbed soils, or soils subject to vibration from construction equipment, traffic, railways, etc., are disqualified as being “Type A.”

Type B - Defined as moderately cohesive soil. Not as good as Type A, but not as bad as Type C soil.

Type C - Defined as the least cohesive soils, having an unconfined compressive strength less than .5 tons per square foot. This includes wet, granular, or loose soils. The best way to remember Type C is to think of the “C” standing for crummy. It is the least stable type of material. The “Competent Person” [CP] is required to perform at least one visual and one manual test of the soil.

Visual Test - To make a visual test, the “Competent Person” observes soil as it is being excavated. Soil that remains in large clumps is cohesive, and is probably Type A or Type B soil (depending upon other factors). Soil that flows out of an excavator bucket is granular, loose, or wet, and is probably

Type C. The CP should also check the sides of the excavation for layered systems, water, utilities, and signs of previously disturbed soils. The CP must also be vigilant for sources of vibration.

Manual Tests - There are a number of different manual tests included in the OSHA Standard.

The Dry Strength, Thread, or Ribbon Tests can be used to determine if a soil is cohesive or granular.

The Thumb Penetration Test relies heavily upon the experience of the person performing the test. In the Thumb Penetration Test, the “Competent Person” gathers a handful of freshly excavated soil and presses his/her thumb into the material. Type A soils require a great amount of effort to indent the soil. Type B soils can be indented with moderate pressure. Type C soils require little or no effort.

Pocket Penetrometers and Shearvanes can be used to determine the approximate unconfined compressive strength of soils.

There is one method of Soil Classification that the CP can employ to avoid all these tests. He/She can assume the “worse case” scenario and classify all soil as Type C. The trench or excavation can then be sloped, shored, or shielded accordingly. In fact, many contractors and utilities take the position that every soil they work in is Type C. That helps to simplify the entire trenching and excavation safety process immensely. ☐

Editor’s Note: This is the third of four articles in this series that discusses specific steps that contractors and utilities can take to help insure the safety of their personnel. Obviously, this is an overview of the subject. It is impossible to properly cover the topic in just four relatively short articles. Contractors and utilities involved in underground work will need additional training to insure worker safety.



A pocket penetrometer is an example of a manual test that can be performed to determine soil type.